

Focused ion beam: a versatile tool for nanostructured device fabrication

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Abstract

Focused Ion Beam (FIB) offers a variety in the nanopatterning because of its ability to localize a desired place on a sample and to remove or add material with a high precision without any resist layer or etching mask. It is one of the most used technique in the semiconductor industry for failure analysis, device modifications, and micro-nanocomponent fabrication [1].

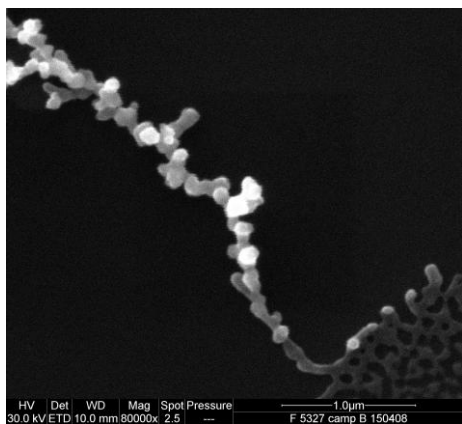
One of its “direct-write” peculiarity is the deposition of nanoelectrodes directly onto the substrates. After electrode deposition, nanoparticle solution can be dropped between them. Applying a dielectrophoresis (DEP) force, nanoparticles will be driven until to have a continuous nanowire/nanostructured material. Results on working devices, obtained starting from palladium nanoparticles, ZnO nanostructures and graphene multilayer flakes dispersed in appropriate solutions, are shown [2].

Another specificity is the ability to mill, opportunely changing the working conditions, different types of materials (metals, insulating, semiconductor, polymer, etc.). Results will be presented on FIB nanopatterning of materials such as optical fibers for multifunctional optical nanoprobe [3] and doped silicon oxide layer in view of light trapping application in thin film photovoltaics [4,5]. Different working conditions, such as ion beam currents, milling times, dwell times, etc., are optimized in order to improve the nanochannel shape by reducing the effect of redeposition of sputtered target material on the sidewalls.

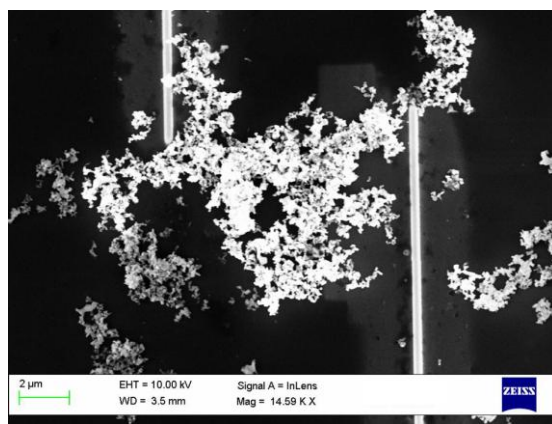
References

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Figures

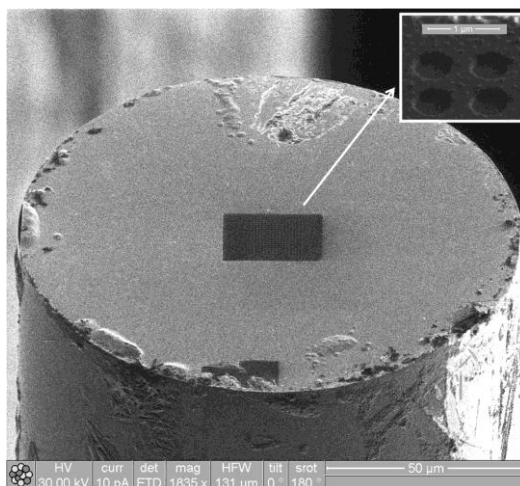


(a)



(b)

SEM images of (a) single palladium nanowire and (b) nanostructured ZnO grown by DEP between two platinum nanoelectrodes deposited by FIB



Ion image of nanopatterning made by FIB on optical fiber. In the inset the magnification of the milling is shown